REMARKS

The Office Action mailed July 13, 2005 has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 1-9, 11-21, and 23-27 are pending in this application. Claims 1-27 stand rejected. Claims 1, 11, 14, 15, 21, 23, 26, and 27 have been amended. No new matter has been added.

Applicants respectfully submit that a copy, with Examiner's initials and signature, of the supplemental information disclosure statement (PTO/SB/08A) filed on December 3, 2003 has not been provided with the Office Action. Applicants respectfully request that an executed copy of the information disclosure statement be provided.

The rejection of Claim 1 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli ("Synchrotron light and imaging systems for medical radiology") in view of Urchuk et al. (U.S. Patent 6,148,057) is respectfully traversed.

Claim 1 recites a method comprising "detecting components of plaque using a multi-energy computed tomography (MECT) system, wherein said detecting the components of the plaque includes generating a look-up table by using at least one phantom; and quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque."

Arfelli describes a method including multiple energy computed tomography (MECT). MECT was first developed at a medical facility with a program for imaging human neck and head with single- and dual-energy methods (page 15, column 2). In the method, dual-photon imaging will be applied in the study of tissue characterization as carotid artery atherosclerotic plaque composition (page 15, column 2).

Urchuk et al. describe a method including generating nonlinear calibration tables using a two-step process (column 6, lines 39-40). First, a set of detector-dependent gain errors is estimated by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom, which is formed from

multiple plastic slabs (column 6, lines 40-45). Next, the error estimates are used to generate an array of polynomial-based look-up tables, one for each X-ray detector (column 6, lines 45-47).

Neither Arfelli nor Urchuk et al., considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, neither Arfelli nor Urchuk et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Accordingly, neither Arfelli nor Urchuk et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and further in view of Urchuk et al.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 1 be withdrawn.

The rejection of Claim 5 and 6 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Vinegar et al. (U.S. Patent 4,571,491) and Tsutsui et al. (U.S. Patent 5,396,530) is respectfully traversed.

Arfelli and Urchuk et al. are described above.

Vinegar et al. describe a method of obtaining an atomic number image of an unknown material (abstract). A plurality of calibration materials which have a plurality of different known atomic numbers and densities are scanned with a computerized axial tomographic scanner (CAT) at first and second energies to determine attenuation coefficients for the plurality of calibration materials at these energies (abstract). Energy-dependent coefficients at the first and second energies are determined from the attenuation coefficients for the plurality of calibration materials at the first and second energies according to a predetermined

relation (abstract). An unknown material is scanned with the CAT at the first and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at these energies (abstract). The determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies are used to determine an atomic number image for the unknown material (abstract).

Tsutsui et al. describe an X-ray source that applies an application voltage of 100 kV to an X-ray tube of a constant voltage of 3 mV to generate an X-ray beam, and the X-ray energy spectrum is divided into two energy bands beforehand by using materials having an energy absorbing end at about 50 KeV denominated a K-edge filter (column 5, lines 16-24). An object is irradiated by the divided X-ray energy bands (column 5, lines 25-26). X-ray photons transmitted through the object are separated into two energy bands by using two discriminator comparators and a pulse counting measurement is conducted by using a one-dimensional semiconductor radiation detector (column 5, lines 27-34).

Claims 5 and 6 depend indirectly from independent Claim 1. None of Arfelli, Urchuk et al., Vinegar et al., and Tsutsui et al., considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Vinegar et al., and Tsutsui et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Vinegar et al. describe scanning a plurality of calibration materials which have a plurality of different known atomic numbers and densities with a computerized axial tomographic scanner (CAT) at first and second energies to determine attenuation coefficients for the plurality of calibration materials at the energies. Vinegar et al. further describe determining energy-dependent coefficients at the first and second energies from the attenuation coefficients for the plurality of calibration materials at the first and second energies. Vinegar et al. also describe scanning an unknown material with the CAT at the first

and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at the energies. Vinegar et al. describe using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies to determine an atomic number image for the unknown material. Tsutsui et al. describe separating X-ray photons transmitted through an object into two energy bands by using two discriminator comparators and conducting a pulse counting measurement by using a one-dimensional semiconductor radiation detector. Accordingly, none of Arfelli, Urchuk et al., Vinegar et al., and Tsutsui et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Vinegar et al. and Tsutsui et al.

When the recitations of Claims 5 and 6 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 5 and 6 likewise are patentable over Arfelli and Urchuk et al., and further in view of Vinegar et al. and Tsutsui et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 5-6 over Arfelli and Urchuk et al., and further in view of Vinegar et al. and Tsutsui et al. be withdrawn.

The rejection of Claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Walters (U.S. Patent 5,115,394) is respectfully traversed.

Arfelli and Urchuk et al. are described above.

Walters describes dual energy scanning systems and methods that are a solution to many problems where two scans are made at a combined dose equal to a dose that would have been used if a single energy scan approach had been used (column 1, lines 55-59). By taking two sets of measurements, one at a high KVP (kilovolts peak) at a specified dose level and another at a low KVP and at a specified corresponding dose level, information may be obtained from which estimates may be made about distribution functions of attenuation coefficients at a given reconstruction energy (column 1, lines 59-65).

Claim 7 depends directly from independent Claim 1. None of Arfelli, Urchuk et al., and Walters, considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., and Walters, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Accordingly, none of Arfelli, Urchuk et al., and Walters, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Walters.

When the recitations of Claim 7 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 7 likewise is patentable over Arfelli and Urchuk et al., and further in view of Walters.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 7 over Arfelli and Urchuk et al., and further in view of Walters be withdrawn.

The rejection of Claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Teirstein et al. (U.S. Patent Application 2001/0018042) and Walters is respectfully traversed.

Arfelli, Urchuk et al., and Walters are described above.

Teirstein et al. describe in vivo methods for detection of vulnerable plaque in a subject in need thereof (abstract). In the methods, the subject is administered a diagnostic amount of a biologically compatible detectable lipid-avid agent, the detectable lipid-avid

agent is allowed to penetrate arterial walls and attach to any lipid accumulations of oxidized LDL-cholesterol in arterial walls in the wall of an artery, unbound detectable lipid-avid agent is allowed to clear from the subject by natural processes, and a presence of the detectable lipid-avid agent attached to the lipid accumulation in the wall of the artery is detected (abstract).

Claim 8 depends directly from independent Claim 1. None of Arfelli, Urchuk et al., Teirstein et al., and Walters, considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Teirstein et al., and Walters, considered alone or in combination, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Teirstein et al. describe detecting a presence of detectable lipid-avid agent attached to a lipid accumulation in a wall of an artery. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Accordingly, none of Arfelli, Urchuk et al., Teirstein et al., and Walters, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Teirstein et al. and Walters

When the recitations of Claim 8 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 8 likewise is patentable over Arfelli and Urchuk et al., and further in view of Teirstein et al. and Walters.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 8 over Arfelli and Urchuk et al., and further in view of Teirstein et al. and Walters.

The rejection of Claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Falotico et al. (U.S. Patent Application 2003/0060877) and Walters is respectfully traversed.

Arfelli, Urchuk et al., and Walters are described above.

Falotico et al. describe new diagnostic technologies to identify a location of vulnerable plaques in a plurality of coronary arteries (paragraph 26). The new technologies include refined magnetic resonance imaging (MRI), thermal sensors that measure a temperature of an arterial wall on a premise that an inflammatory process generates heat, elasticity sensors, intravascular ultrasound, optical coherence tomography (OCT), contrast agents, and near-infrared and infrared light (paragraph 26).

Claim 9 depends directly from independent Claim 1. None of Arfelli, Urchuk et al., Falotico et al., and Walters, considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Falotico et al., and Walters, considered alone or in combination, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Falotico et al. describe identifying a location of vulnerable plaques in a plurality of coronary arteries by using contrast agents. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Accordingly, none of Arfelli, Urchuk et al., Falotico et al., and Walters, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Falotico et al. and Walters.

When the recitations of Claim 9 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 9 likewise is patentable over Arfelli and Urchuk et al., and further in view of Falotico et al. and Walters.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 9 over Arfelli and Urchuk et al., and further in view of Falotico et al. and Walters.

The rejection of Claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Arnold (U.S. Patent 5,335,260) is respectfully traversed.

Arfelli and Urchuk et al. are described above.

Arnold describes a method that utilizes an improved calibration phantom formed of a material which simulates properties of human tissue and contains calcium in a stable configuration (column 2, lines 48-54). The method provides improved accuracy and precision in quantification of calcium, bone mass and bone density by using conventional X-ray equipment (column 2, lines 48-54).

Claim 10 has been canceled.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 10 over Arfelli and Urchuk et al., and further in view of Arnold be withdrawn.

The rejection of Claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al. (U.S. Patent Application Publication 2003/0095693) is respectfully traversed.

Arfelli, Urchuk et al., and Arnold are described above.

Kaufman et al. describe coronary artery calcium quantitation that is a major focus in the effort to assess risk for coronary heart disease, to monitor progression of plaque development, and to potentially assess therapies and interventions designed to reduce mortality from coronary heart disease (paragraph 4). Although a rupture of soft plaque and subsequent thrombus formation is a major precursor of acute coronary events, in most

individuals it is believed that coronary calcium burden is also a valid surrogate or indicator of total plaque burden, including soft plaque (paragraph 4).

Claim 11 depends indirectly from independent Claim 1. None of Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Arnold describes utilizing an improved calibration phantom formed of a material which simulates properties of human tissue and contains calcium in a stable configuration. Kaufman et al. describe indicating total plaque burden by quantifying coronary calcium burden. Accordingly, none of Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al.

When the recitations of Claim 11 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 11 likewise is patentable over Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 11 over Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al.

The rejection of Claim 12 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Charles, Jr. et al. (U.S. Patent 6,816,564) and Fox et al. (U.S. Patent 5,668,846) is respectfully traversed.

Arfelli and Urchuk et al. are described above.

Charles, Jr. et al. describe a method in which two attenuations HH and HL at each pixel are used with a pair of functions of attenuation to compute equivalent thicknesses of the calibration materials, e.g., aluminum and acrylic (column 15, line 66 – column 15, line 3). HH is the attenuation at a high x-ray photon energy and HL is the attenuation at a low x-ray photon energy (column 15, lines 4-5). A proportionality relationship is then used to compute a tissue density based on the equivalent thicknesses of the calibration materials (column 16, lines 3-5).

Fox et al. describe a method in which a three dimensional image may be nutated (column 7, lines 13-15). The image may be nutated with a nutation angle to display the three dimensional image from varying points of view (column 7, lines 13-15).

Claim 12 depends directly from independent Claim 1. None of Arfelli, Urchuk et al., Charles, Jr. et al., and Fox et al., considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Charles, Jr. et al., and Fox et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Charles, Jr. et al. describe using a proportionality relationship to compute a tissue density based on equivalent thicknesses of a plurality of calibration materials. Fox et al. describe nutating a three-dimensional image with a nutation angle to display the three dimensional image from varying points of view. Accordingly, none of Arfelli, Urchuk et al., Charles, Jr. et al., and Fox et al., considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Charles, Jr. et al. and Fox et al.

When the recitations of Claim 12 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 12 likewise is patentable over Arfelli and Urchuk et al., and further in view of Charles, Jr. et al. and Fox et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 12 over Arfelli and Urchuk et al., and further in view of Charles, Jr. et al. and Fox et al.

The rejection of Claim 13 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli and Urchuk et al., and further in view of Vaillant et al. (EP 1087339), Regulla et al. (U.S. Patent 6,001,054), Gayer et al. (U.S. Patent 6,094,467), and Walters is respectfully traversed.

Arfelli, Urchuk et al., and Walters are described above.

Vaillant et al. describe a method in which stents are placed in coronary arteries (paragraph 3). The method also includes reconstructing a three-dimensional image of an element of interest like, for example, a vascular stent inserted in an organ such as a vessel (paragraph 5).

Regulla et al. describe a method for differential energy application for local dose enhancement of ionizing radiation. The method includes implanting a metallic stent which has not been made radioactive, to maintain a lumen of a carotid artery open to allow adequate flow of blood therethrough (column 4, lines 30-36).

Gayer et al. describe a method for improving visual definition in a CT X-ray image having high attenuation objects such as metal prostheses and implants (abstract). The method provides for determining extents of the high attenuation objects and reducing artifacts that the high attenuation objects cause in the image without completely removing the high attenuation objects from the image (abstract).

Claim 13 depends directly from independent Claim 1. None of Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image

of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Vaillant et al. describe reconstructing a three-dimensional image of an element of interest like, for example, a vascular stent inserted in an organ such as a vessel. Regulla et al. describe implanting a metallic stent which has not been made radioactive, to maintain a lumen of a carotid artery open to allow adequate flow of blood therethrough. Gayer et al. describe determining extents of high attenuation objects and reducing artifacts that the high attenuation objects cause in an image without completely removing the high attenuation objects from the image. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Accordingly, none of Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli and Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters.

When the recitations of Claim 13 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 13 likewise is patentable over Arfelli and Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 13 over Arfelli and Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters.

The rejection of Claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli in view of Urchuk et al. and Vinegar et al. is respectfully traversed.

Arfelli, Urchuk et al., and Vinegar et al. are described above.

Claim 14 recites a method for detecting components of plaque comprising "generating information regarding projection data of phantoms by using a multi-energy computed tomography (MECT) system; generating a look-up table by using one of the phantoms; obtaining the components of the plaque from the information; and enabling visualization of restenosis within one of a metal stent and a metal valve by repeating said obtaining the components of plaque after scanning a patient having the one of the metal stent and the metal valve."

None of Arfelli, Urchuk et al., and Vinegar et al., considered alone or in combination, describe or suggest a method for detecting components of plaque as recited in Claim 14. Specifically, none of Arfelli, Urchuk et al., and Vinegar et al., considered alone or in combination, describe or suggest enabling visualization of restenosis within one of a metal stent and a metal valve by repeating the obtaining the components of plaque after scanning a patient having the one of the metal stent and the metal valve. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Vinegar et al. describe scanning a plurality of calibration materials which have a plurality of different known atomic numbers and densities with a computerized axial tomographic scanner (CAT) at first and second energies to determine attenuation coefficients for the plurality of calibration materials at the energies. Vinegar et al. further describe determining energy-dependent coefficients at the first and second energies from the attenuation coefficients for the plurality of calibration materials at the first and second energies. Vinegar et al. also describe scanning an unknown material with the CAT at the first and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at the energies. Vinegar et al. describe using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies to determine an atomic number image for the unknown material. Accordingly, none of Arfelli, Urchuk et al., and Vinegar et al., considered alone or in combination, describe or suggest enabling visualization of restenosis within one of a metal stent and a metal valve by repeating the obtaining the components of plaque after

scanning a patient as recited in Claim 14. For the reasons set forth above, Claim 14 is submitted to be patentable over Arfelli in view of Urchuk et al. and Vinegar et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 14 over Arfelli in view of Urchuk et al. and Vinegar et al.

The rejection of Claim 15 under 35 U.S.C. § 103(a) as being unpatentable over Schanen (U.S. Patent 5,218,533) in view of Arfelli and Urchuk et al. is respectfully traversed.

Arfelli and Urchuk et al. are described above.

Schanen describes a CT system. The CT system includes a CT gantry (16), that includes an x-ray source (10) oriented to project a fan beam of x-rays (24) from a focal spot (11) through an imaged object (12) to a detector array (18) (column 4, lines 31-36).

Claim 15 recites a multi-energy computed tomography (MECT) system comprising "at least one radiation source configured to transmit x-rays that intersect an object; at least one detector configured to detect the x-rays; a controller coupled to the detector; and a computer configured to: instruct the MECT system to detect components of plaque; generate a look-up table by using at least one phantom; repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque."

None of Schanen, Arfelli, and Urchuk et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, and Urchuk et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error

estimates. Accordingly, none of Schanen, Arfelli, and Urchuk et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen in view of Arfelli and Urchuk et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 15 over Schanen in view of Arfelli and Urchuk et al. be withdrawn.

The rejection of Claim 19 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and further in view of Walters and Aradate et al. (U.S. Patent Application Publication 2002/0131544) is respectfully traversed.

Schanen, Arfelli, Urchuk et al., and Walters are described above.

Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data (paragraph 65). Examples of the computer-readable media are compact discs, hard disks, floppy disks, tape, magneto-optical disks, PROMs (EPROM, EEPROM, Flash EPROM), DRAM, SRAM, and SDRAM (paragraph 65).

Claim 19 depends directly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Urchuk et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Walters describes taking two sets of measurements, one at a

high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Accordingly, none of Schanen, Arfelli, Urchuk et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al., and further in view of Walters and Aradate et al.

When the recitations of Claim 19 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 19 likewise is patentable over Schanen, Arfelli, Urchuk et al., and further in view of Walters and Aradate et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 19 over Schanen, Arfelli, Urchuk et al., and further in view of Walters and Aradate et al. be withdrawn.

The rejection of Claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and further in view of Teirstein et al., Walters and Aradate et al. is respectfully traversed.

Schanen, Arfelli, Urchuk et al., Teirstein et al., Walters, and Aradate et al. are described above.

Claim 20 depends directly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Teirstein et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Urchuk et al., Teirstein et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and

applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Teirstein et al. describe detecting a presence of detectable lipid-avid agent attached to a lipid accumulation in a wall of an artery. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Accordingly, none of Schanen, Arfelli, Urchuk et al., Teirstein et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al., and further in view of Teirstein et al., Walters and Aradate et al.

When the recitations of Claim 20 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 20 likewise is patentable over Schanen, Arfelli, Urchuk et al., and further in view of Teirstein et al., Walters and Aradate et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 20 over Schanen, Arfelli, Urchuk et al., and further in view of Teirstein et al., Walters and Aradate et al. be withdrawn.

The rejection of Claim 21 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and further in view of Falotico et al., Walters, and Aradate et al. is respectfully traversed.

Schanen, Arfelli, Urchuk et al., Falotico et al., Walters, and Aradate et al. are described above.

Claim 21 depends directly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Falotico et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15.

Specifically, none of Schanen, Arfelli, Urchuk et al., Falotico et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Falotico et al. describe identifying a location of vulnerable plaques in a plurality of coronary arteries by using contrast agents. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Accordingly, none of Schanen, Arfelli, Urchuk et al., Falotico et al., Walters, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al., and further in view of Falotico et al., Walters, and Aradate et al.

When the recitations of Claim 21 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 21 likewise is patentable over Schanen, Arfelli, Urchuk et al., and further in view of Falotico et al., Walters, and Aradate et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 21 over Schanen, Arfelli, Urchuk et al., and further in view of Falotico et al., Walters, and Aradate et al. be withdrawn.

The rejection of Claim 22 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, and Urchuk et al., and further in view of Arnold is respectfully traversed.

Claim 22 has been canceled.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 22 over Schanen, Arfelli, Urchuk et al., and further in view of Arnold.

The rejection of Claim 23 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and Arnold, and further in view of Kaufman et al. is respectfully traversed.

Schanen, Arfelli, Urchuk et al., Arnold, and Kaufman et al. are described above.

Claim 23 depends indirectly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Arnold describes utilizing an improved calibration phantom formed of a material which simulates properties of human tissue and contains calcium in a stable configuration. Kaufman et al. describe indicating total plaque burden by quantifying coronary calcium burden. Accordingly, none of Schanen, Arfelli, Urchuk et al., Arnold, and Kaufman et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al..

When the recitations of Claim 23 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 23 likewise is patentable over Schanen, Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 23 over Schanen, Arfelli, Urchuk et al. and Arnold, and further in view of Kaufman et al. be withdrawn.

The rejection of Claim 24 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and further in view of Charles, Jr. et al., Fox et al. and Aradate et al. is respectfully traversed.

Schanen, Arfelli, Urchuk et al., Charles, Jr. et al., Fox et al. and Aradate et al. are described above.

Claim 24 depends directly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Charles, Jr. et al., Fox et al. and Aradate et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Urchuk et al., Charles, Jr. et al., Fox et al. and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Charles, Jr. et al. describe using a proportionality relationship to compute a tissue density based on equivalent thicknesses of a plurality of calibration materials. Fox et al. describe nutating a three-dimensional image with a nutation angle to display the three dimensional image from varying points of view. Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Accordingly, none of Schanen, Arfelli,

Urchuk et al., Charles, Jr. et al., Fox et al. and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al., and further in view of Charles, Jr. et al., Fox et al., and Aradate et al.

When the recitations of Claim 24 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 24 likewise is patentable over Schanen, Arfelli, Urchuk et al., and further in view of Charles, Jr. et al., Fox et al., and Aradate et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 24 over Schanen, Arfelli, Urchuk et al., and further in view of Charles, Jr. et al., Fox et al., and Aradate et al. be withdrawn.

The rejection of Claim 25 under 35 U.S.C. § 103(a) as being unpatentable over Schanen, Arfelli, Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters is respectfully traversed.

Schanen, Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters are described above.

Claim 25 depends directly from independent Claim 15. None of Schanen, Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. describe estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed

with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates. Vaillant et al. describe reconstructing a three-dimensional image of an element of interest like, for example, a vascular stent inserted in an organ such as a vessel. Regulla et al. describe implanting a metallic stent which has not been made radioactive, to maintain a lumen of a carotid artery open to allow adequate flow of blood therethrough. Gayer et al. describe determining extents of high attenuation objects and reducing artifacts that the high attenuation objects cause in an image without completely removing the high attenuation objects from the image. Walters describes taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Accordingly, none of Schanen, Arfelli, Urchuk et al., Vaillant et al., Regulla et al., Gayer et al., and Walters, considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen, Arfelli, Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters.

When the recitations of Claim 25 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 25 likewise is patentable over Schanen, Arfelli, Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 25 over Schanen, Arfelli, Urchuk et al., and further in view of Vaillant et al., Regulla et al., Gayer et al., and Walters be withdrawn.

The rejection of Claims 26 and 27 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli in view of Zmora (U.S. Patent 6,028,909) and Ito et al. (U.S. Patent 5,122,664) is respectfully traversed.

Arfelli is described above.

Zmora describes a computer-based system and a method for correction of artifacts in computed tomography images (column 8, lines 24-25). The method could be programmed in a computer initially, or added later in an upgraded software package (column 8, lines 25-27).

Ito et al. describe a method in which a subtraction image S thus displayed is composed of a pattern S1 of a bone of an object (1) and a pattern S5 of a phantom 5 (column 13, lines 17-19). Therefore, the pattern S1 of the bone of the object and the pattern S5 of the phantom can be observed simultaneously (column 13, lines 19-21). One of a plurality of step-like sections in the pattern S5 of the phantom is found, which has an image density equal or close to the image density of a specific part of the pattern S1 of the bone, which part is to be analyzed for a determination of an amount of bone calcium (column 13, lines 21-26). Thereafter, the amount of bone calcium can be determined which corresponds to the image density (column 13, lines 26-28).

Claim 26 recites a computer readable medium encoded with a program configured to "instruct a computer to detect components of plaque within an object that is scanned using a multi-energy tomography (MECT) system, the program further configured to instruct the computer to generate, by using at least one phantom, a look-up table that maps different densities of a selected basis material of the phantom to projection data for different energy spectra, and to repeat the detection of the components of the plaque after instructing a user to administer a contrast agent to accentuate a visualization of the plaque."

None of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest a computer readable medium as recited in Claim 26. Specifically, none of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest a program further configured to instruct the computer to repeat the detection of the components of the plaque after instructing a user to administer a contrast agent to accentuate a visualization of the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Zmora describes correcting artifacts in computed tomography images. Ito et al. describe finding one of a plurality of step-like sections in a pattern of a phantom, which has an image density equal or close to an image density of a specific part of a pattern of a bone. Ito et al. further describe determining an amount of bone calcium corresponding to the image density. Accordingly, none of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest a program further configured to instruct the computer to repeat the detection of the components of the plaque after instructing a user to administer a contrast agent to accentuate a visualization of the plaque as recited in

Claim 26. For the reasons set forth above, Claim 26 is submitted to be patentable over Arfelli in view of Zmora and Ito et al..

Claim 27 recites a computer encoded with "a program configured to instruct an MECT system to detect components of plaque within an object that is scanned using the MECT system, the program further configured to instruct the computer to generate, by using at least one phantom, a look-up table that maps different densities of a selected basis material of the phantom to projection data for different energy spectra, and to quantify the components of the plaque by determining a weighted sum of densities, greater than a specific amount, of pixels of an image of an organ including the plaque."

None of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest a computer as recited in Claim 27. Specifically, none of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest the program further configured to quantify the components of the plaque by determining a weighted sum of densities, greater than a specific amount, of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Zmora describes correcting artifacts in computed tomography images. Ito et al. describe finding one of a plurality of step-like sections in a pattern of a phantom, which has an image density equal or close to an image density of a specific part of a pattern of a bone. Ito et al. further describe determining an amount of bone calcium corresponding to the image density. Accordingly, none of Arfelli, Zmora, and Ito et al., considered alone or in combination, describe or suggest to quantify the components of the plaque by determining a weighted sum of densities, greater than a specific amount, of pixels of an image of an organ as recited in Claim 27. For the reasons set forth above, Claim 27 is submitted to be patentable over Arfelli in view of Zmora and Ito et al..

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 26 and 27 over Arfelli in view of Zmora and Ito et al. be withdrawn.

The rejection of Claim 1-4 under 35 U.S.C. § 103(a) as being unpatentable over Arfelli in view of Vinegar et al., Lazos et al. ("A Software Data Generator for Radiograph Imaging Investigations"), and Adriaansz (U.S. Patent 6,574,302) is respectfully traversed.

Arfelli and Vinegar et al. are described above.

Lazos et al. describe a method for developing and implementing an integrated software application used to create electronic phantoms, which can be subsequently subjected to a simulated X-ray imaging procedure to produce radiographic projection images (page 76, Introduction). Each of the images are composed on calculated intensity pixel values of transmitted radiation fluence reaching a detector (page 76, Introduction).

Adriaansz describes a method in which a value of a bone mineral density factor to be used can be looked up in a look-up table (column 4, lines 50-53). When the bone mineral density factor has been determined a priori, the values of this factor can be stored in a look-up table that is stored in a memory of a computer (column 4, lines 53-56).

Claim 1 is recited above. None of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest a method as recited in Claim 1. Specifically, none of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities of pixels of an image of an organ including the plaque. Rather, Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Vinegar et al. describe scanning a plurality of calibration materials which have a plurality of different known atomic numbers and densities with a computerized axial tomographic scanner (CAT) at first and second energies to determine attenuation coefficients for the plurality of calibration materials at the energies. Vinegar et al. further describe determining energy-dependent coefficients at the first and second energies from the attenuation coefficients for the plurality of calibration materials at the first and second energies. Vinegar et al. also describe scanning an unknown material with the CAT at the first and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at the energies. Vinegar et al. describe using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies to determine an atomic number image for the unknown material. Lazos et al. describe developing and implementing an integrated software application used to create electronic phantoms, which can be subsequently subjected to a simulated X-ray imaging procedure to produce radiographic projection images. Adriaansz

describes viewing a value of a bone mineral density factor in a look-up table. Accordingly, none of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest quantifying the components of the plaque by determining a weighted sum of densities as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Arfelli, and further in view of Vinegar et al., Lazos et al., and Adriaansz.

Claims 2-4 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 2-4 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-4 likewise are patentable over Arfelli, and further in view of Vinegar et al., Lazos et al., and Adriaansz.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1-4 over Arfelli, and further in view of Vinegar et al., Lazos et al., and Adriaansz be withdrawn.

The rejection of Claims 15-17 under 35 U.S.C. § 103(a) as being unpatentable over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz is respectfully traversed.

Schanen, Arfelli, Vinegar et al., Lazos et al., and Adriaansz are described above.

Claim 15 is recited above.

None of Schanen, Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Vinegar et al. describe using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material

at the first and second energies to determine an atomic number image for the unknown material. Lazos et al. describe developing and implementing an integrated software application used to create electronic phantoms, which can be subsequently subjected to a simulated X-ray imaging procedure to produce radiographic projection images. Adriaansz describes viewing a value of a bone mineral density factor in a look-up table. Accordingly, none of Schanen, Arfelli, Vinegar et al., Lazos et al., and Adriaansz, considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz.

When the recitations of Claims 16 and 17 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claims 16 and 17 likewise are patentable over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 15-17 over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz be withdrawn.

The rejection of Claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, and further in view of Aradate et al. is respectfully traversed.

Schanen, Arfelli, Vinegar et al., Lazos et al., Adriaansz, and Aradate et al. are described above.

Claim 18 depends indirectly from independent Claim 15. None of Schanen, Arfelli, Vinegar et al., Lazos et al., Adriaansz, and Aradate et al., considered alone or in combination, describe or suggest a multi-energy computed tomography system as recited in Claim 15. Specifically, none of Schanen, Arfelli, Vinegar et al., Lazos et al., Adriaansz, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent to accentuate a visualization of the plaque. Rather, Schanen describes a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to

a detector array. Arfelli describes performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Vinegar et al. further describe determining energy-dependent coefficients at the first and second energies from the attenuation coefficients for the plurality of calibration materials at the first and second energies. Vinegar et al. also describe scanning an unknown material with the CAT at the first and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at the energies. Vinegar et al. describe using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies to determine an atomic number image for the unknown material. Lazos et al. describe developing and implementing an integrated software application used to create electronic phantoms, which can be subsequently subjected to a simulated X-ray imaging procedure to produce radiographic projection images. Adriaansz describes viewing a value of a bone mineral density factor in a look-up table. Aradate et al. describe at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Accordingly, none of Schanen, Arfelli, Vinegar et al., Lazos et al., Adriaansz, and Aradate et al., considered alone or in combination, describe or suggest a computer configured to repeat the detection of the components of the plaque after instructing a user to administer a temperature-sensitive contrast agent as recited in Claim 15. For the reasons set forth above, Claim 15 is submitted to be patentable over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, and further in view of Aradate et al.

When the recitations of Claim 18 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claim 18 likewise is patentable over Schanen in view of Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, and further in view of Aradate et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 18 over Schanen in view of Arfelli, Vinegar et al., Lazos et al., and Adriaansz, and further in view of Aradate et al. be withdrawn.

Moreover, Applicants respectfully submit that the Section 103 rejections of Claims 1-27 are not proper rejections. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some

teaching, suggestion, or incentive supporting the combination. None of Urchuk et al., Arfelli, Vinegar et al., Lazos et al., Adriaansz, Tsutsui et al., Walters, Teirstein et al., Falotico et al., Arnold, Kaufman et al., Charles, Jr. et al., Fox et al., Ito et al., Vaillant et al., Regulla et al., Gayer et al., Schanen, Aradate et al., and Zmora, considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Urchuk et al. with Arfelli, Vinegar et al., Lazos et al., Adriaansz, Tsutsui et al., Walters, Teirstein et al., Falotico et al., Arnold, Kaufman et al., Charles, Jr. et al., Fox et al., Ito et al., Vaillant et al., Regulla et al., Gayer et al., Schanen, Aradate et al., or Zmora because there is no motivation to combine the references suggested in the cited art itself.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicants' disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejections are based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Arfelli teaches performing multiple energy computed tomography and applying dual-photon imaging in the study of tissue characterization as carotid artery atherosclerotic plaque composition. Urchuk et al. teach estimating a set of detector-dependent gain errors by high-pass filtering attenuation measurements performed

with a stationary gantry over varying thicknesses of a calibration phantom and generating an array of polynomial-based look-up tables from the error estimates.

Moreover, Vinegar et al. teach scanning a plurality of calibration materials which have a plurality of different known atomic numbers and densities with a computerized axial tomographic scanner (CAT) at first and second energies to determine attenuation coefficients for the plurality of calibration materials at the energies. Vinegar et al. further teach determining energy-dependent coefficients at the first and second energies from the attenuation coefficients for the plurality of calibration materials at the first and second energies. Vinegar et al. also teach scanning an unknown material with the CAT at the first and second energies to determine the attenuation coefficients at a plurality of points in a cross section of the unknown material at the energies. Vinegar et al. teach using the determined energy-dependent coefficients and the determined attenuation coefficients for the unknown material at the first and second energies to determine an atomic number image for the unknown material. Tsutsui et al. teach separating X-ray photons transmitted through an object into two energy bands by using two discriminator comparators and conducting a pulse counting measurement by using a one-dimensional semiconductor radiation detector. Teirstein et al. teach detecting a presence of detectable lipid-avid agent attached to a lipid accumulation in a wall of an artery. Walters teaches taking two sets of measurements, one at a high kilovolts peak (KVP) at a specified dose level, and another at a low KVP and at a specified corresponding dose level. Vaillant et al. teach reconstructing a three-dimensional image of an element of interest like, for example, a vascular stent inserted in an organ such as a vessel. Regulla et al. teach implanting a metallic stent which has not been made radioactive, to maintain a lumen of a carotid artery open to allow adequate flow of blood therethrough. Gayer et al. teach determining extents of high attenuation objects and reducing artifacts that the high attenuation objects cause in an image without completely removing the high attenuation objects from the image. Lazos et al. teach developing and implementing an integrated software application used to create electronic phantoms, which can be subsequently subjected to a simulated X-ray imaging procedure to produce radiographic projection images. Adriaansz teaches viewing a value of a bone mineral density factor in a look-up table. Falotico et al. teach identifying a location of vulnerable plaques in a plurality of coronary arteries by using contrast agents. Arnold teaches utilizing an improved calibration phantom formed of a material which simulates properties of human tissue and contains calcium in a stable configuration.

Furthermore, Kaufman et al. teach indicating total plaque burden by quantifying coronary calcium burden. Charles, Jr. et al. teach using a proportionality relationship to compute a tissue density based on equivalent thicknesses of a plurality of calibration materials. Fox et al. describe nutating a three-dimensional image with a nutation angle to display the three dimensional image from varying points of view. Schanen teaches a CT system that includes a CT gantry. The CT gantry includes an x-ray source oriented to project a fan beam of x-rays from a focal spot through an imaged object to a detector array. Zmora teaches correcting artifacts in computed tomography images. Ito et al. teach finding one of a plurality of step-like sections in a pattern of a phantom, which has an image density equal or close to an image density of a specific part of a pattern of a bone Ito et al. further describe determining an amount of bone calcium corresponding to the image density. Aradate et al. teach at least one computer-readable medium or memory for storing data structures, tables, records, or other data. Since there is no teaching nor suggestion in the cited art for the combination, the Section 103 rejections appear to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejections of Claims 1-27 be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the rejections of Claims 1-27 under 35 U.S.C. 103(a) be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

William J. Zychlewicz
Registration No.: 51366
ARMSTRONG TEASDALE LLP
One Metropolitan Square, Suite 2600
St. Louis, Missouri 63102-2740
(314) 621-5070